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IS 5433 (1969): Oil well steel casing pipes and couplings [MTD 19: Steel Tubes, Pipes abd Fittings]

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SPECIFICATION FOR OIL WELL STEEL CASING PIPES AND COUPLINGS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 6 *September* 1970

IS : 5433 - 1969

Indian Standard

SPECIFICATION FOR OIL WELL STEEL CASING PIPES AND COUPLINGS

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Indian Standard

SPECIFICATION FOR OIL WELL STEEL CASING PIPES AND COUPLINGS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 15 December 1969, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Keeping in view the manufacturing and trade practices followed in the country this standard has been prepared to meet the increased application of oil well casing pipes and couplings. In preparing this standard assistance has been derived from API Standard 5A-March 1968 — API 'Specification for casing, tubing and drill pipe'.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements for seamless and electric welded oil well steel casing pipes and seamless couplings.

2. SUPPLY OF MATERIAL

2.1 General requirements relating to the supply of oil well casing pipes and couplings shall conform to IS 1387-1967†

3. GRADES

3.1 Steel casing pipes and couplings shall be of three grades depending on the minimum yield strength, namely, YSt 28, YSt 39 and YSt 56.

---

*Rules for rounding off numerical values (*revised*).

†General requirements for the supply of metallurgical materials (*first revision*).

4. MANUFACTURE

4.1 Steel for pipes and couplings shall be manufactured by open hearth, electric, basic oxygen or a combination of these processes. In case any other process is employed by the manufacturer, prior approval of the purchaser should be obtained. If basic oxygen process is employed for the manufacture, the nitrogen content of the steel shall not exceed 0·007 percent.

4.2 The casing pipes shall be manufactured by any one of the following processes

a) Hot finished seamless (HFS);
b) Cold drawn seamless (CDS), and
c) Electric-welded pipe having one longitudinal seam formed by electric-flash or electric resistance welding (ERW), without the addition of extraneous metal

4.2.1 Grades YSt 39 and YSt 56 casing pipes shall be normalized if so specified by the purchaser.

4.3 The couplings for pipes shall be manufactured by seamless process.

5. CHEMICAL REQUIREMENTS

5.1 Ladle Analysis — When requested by the purchaser, the manufacturer shall furnish a report giving the ladle analysis of each heat of steel. The steel when analyzed in accordance with IS 228-1959*, shall show not more than 0·06 percent of sulphur and 0·04 percent of phosphorus.

5.2 Product Analysis — Two samples shall be analyzed for product analysis, one from each of two lengths of pipe from each lot of 400 lengths or less of each size 139·7 mm and smaller, and one from each of two lengths of pipe from each lot of 200 lengths or less of each size 168·3 mm and larger For multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length. The sample shall be composed of cuttings or drillings representing the full wall thickness of the casing pipe taken from several points around the pipe or at the option of the manufacturer, across the skelp for welded pipe. If drillings are used, the minimum drill size shall be 12·7 mm.

5.3 Recheck Analysis — If the product analysis of both lengths of pipe representing the lot fails to conform to the specified requirements, at the manufacturer's option either the lot shall stand rejected or two

---

*Methods of chemical analysis of pig iron, cast iron and plain carbon and low-alloy steels (*revised*).

AMENDMENT NO. 1 JULY 1983

TO

IS:5433-1969 SPECIFICATION FOR OIL WELL STEEL CASING PIPES AND COUPLINGS

Alterations

(*Page 4, clause 5.1*) - Substitute the following for the existing clause:

'5.1 When requested by the purchaser, the manufacturer shall furnish a report giving the ladle analysis of each heat of steel.

5.1.1 The steel shall show, not more than 0.06 percent of sulphur and 0.04 percent of phosphorus.

5.1.2 The analysis of steel shall be carried out either by the method specified in IS:228* and its relevant parts or any other established instrumental/ chemical method. In case of dispute the procedure given in IS:228* and its relevant parts shall be referee method. However, where the method is not given in IS:228* and its relevant parts, the referee method shall be agreed to between the purchaser and the manufacturer.'

(*Page 4, foot-note with '*' mark*) - Substitute the following for the existing foot-note:

'*Methods for chemical analysis of steels.'

(SMDC 22)

Reprography Unit, BIS, New Delhi, India

recheck analyses shall be made on two additional lengths from the same lot. If both recheck analyses conform to the requirements, the lot shall be accepted except for the length represented by the initial analysis which failed. If one or both of the recheck analyses fail at the manufacturer's option, the entire lot shall be rejected or each of the remaining lengths shall be tested individually. In the individual testing of the remaining lengths in any lot, analysis for only the rejecting element or elements need be determined. Samples for recheck analysis shall be taken in the same manner as specified for product analysis samples.

5.4 Mill Control Product Analysis — A product analysis shall be made by the manufacturer as a mill control of each heat of steel used for the production of pipe under this specification. A record of such analyses shall be available to the purchaser.

6. DIMENSIONS AND WEIGHTS

6.1 Dimensions and weights of casing pipes shall conform to the requirements specified in Tables 1 and 2

NOTE — If long-thread grade YSt 39 casing pipes in accordance with Table 2 is desired, the purchaser shall specify accordingly in the purchase order, otherwise short-thread casing pipes shall be supplied in accordance with Table 1 If special threads or end finish is desired, it shall be agreed to between the purchaser and the manufacturer and the requirements shall be specified in the purchase order

6.1.1 *Weight* — Each length of casing pipe shall be weighed separately. Threaded and coupled pipe shall be weighed with the coupling screwed on Threaded and coupled pipe, integral joint pipe and pipes shipped without coupling shall be weighed without thread protectors except for carload weighings, for which proper allowances shall be made for the weight of the thread protectors.

6.1.2 *Length* — Pipes shall be furnished in range of lengths given in Table 3. When pipe is furnished with threads and couplings (*see* Fig. 1) the length shall be measured to the outer face of the coupling.

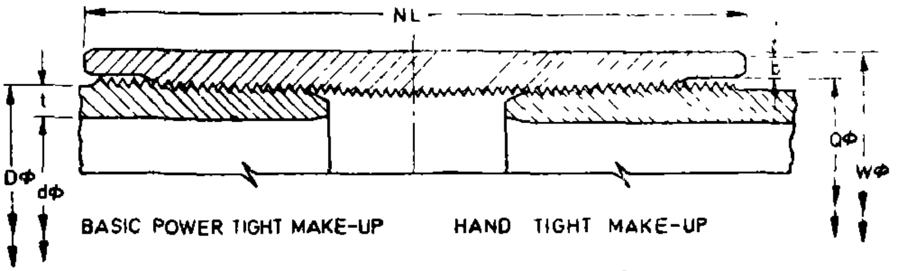

FIG. 1 ROUND-THREAD CASING AND COUPLING

TABLE 1 SHORT ROUND-THREAD CASING DIMENSIONS, WEIGHTS AND TEST PRESSURES

(*Clauses* 6.1, 9.3.2 *and* 12.1, and *Fig.* 1)

SIZE OUTSIDE DIAMETER, *D*	WALL THICKNESS, *t*	INSIDE DIAMETER, *d*	CALCULATED WEIGHT		CALCULATED COUPLING WEIGHT	TEST PRESSURE				
						Standard			Alternative†	
			Plain End, W_{pe}	Threads and Coupling*, W		Grade YSt 28	Grade YSt 39	Grade YSt 56	Grade YSt 28	Grade YSt 39
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
mm	mm	mm	kg/m	kg/m	kg	kg/cm²	kg/cm²	kg/cm²	kg/cm²	kg/cm²
114·3	5·21	103·9	13·99	14·30	3·651	204	211	—	‡204	281
114·3	5·69	102·9	15·22	15·51	3·651	—	211	—	—	309
114·3	6·35	101·6	16·89	17·14	3·651		211	—	—	344
127·0	5·59	115·8	16·71	17·11	4·618	—	211	—	—	274
127·0	6·43	114·1	19·09	19·45	4·618	—	211	—	—	316
127·0	7·52	112·0	22·13	22·44	4·618	—	211	—	—	366
139·7	6·20	127·3	20·39	20·79	5·189	197	211	—	‡197	274
139·7	6·98	125·7	22·84	23·20	5·189	—	211	—	—	309
139·7	7·72	124·3	25·11	25·43	5·189	—	211	—	—	344
168·3	7·32	153·7	29·01	29·82	9·058	197	211	—	‡197	267
168·3	8·94	150·4	35·09	35·81	9·058	—	211	—	—	330
177·8	5·87	166·1	24·85	25·60	8·319	148	—	—	‡148	—
177·8	6·91	164·0	29·08	29·78	8·319	176	211	—	‡176	239
177·8	8·05	161·7	33·68	34·27	8·319	—	211	—	—	281
177·8	9·19	159·4	38·19	38·72	8·319	—	211	—	—	323
193·7	7·62	178·5	34·93	36·10	12·215	176	—	—	‡176	—
193·7	8·33	177·0	38·04	39·17	12·215	—	211	—	—	267

219·1	6·71	205·7	35·08	36·83	16·139	—	190	—	—	*190
219·1	7·72	203·7	40·21	41·86	16·139	162	—	—	‡162	—
219·1	8·94	201·2	46·28	47·83	16·139	183	211	—	‡183	253
219·1	10·16	198·8	52·30	53·74	16·139	—	211	—	—	288
244·5	7·92	228·7	46·18	47·99	17·921	148	—	—	‡148	—
244·5	8·94	226·0	51·88	53·59	17·921	162	211	—	‡162	225
244·5	10·03	224·6	57·95	59·54	17·921	—	211	—	—	253
273·0	7·09	258·8	46·43	48·59	20·652	84	—	—	120	—
273·0	8·89	255·2	57·86	59·83	20·652	112	148	—	148	204
273·0	10·16	252·7	65·81	67·62	20·652	—	176	—	—	232
273·0	11·43	250·1	73·67	75·35	20·652	—	197	380	—	260
273·0	12·57	247·9	80·68	82·22	20·652	—	—	415	—	—
298·4	8·46	281·5	60·42	62·62	22·503	98	—	—	127	—
298·4	9·52	279·4	67·80	69·86	22·503	—	148	—	—	197
298·4	11·05	276·3	78·23	80·09	22·503	—	169	—	—	232
298·4	12·42	273·6	87·52	89·20	22·503	—	190	373	—	260
339·7	8·38	322·9	68·43	70·90	25·505	84	—	—	112	—
339·7	9·65	320·4	78·49	80·78	25·505	—	134	—	—	176
339·7	10·92	317·9	88·47	90·59	25·505	—	148	—	—	197
339·7	12·19	315·3	98·38	100·30	25·505	—	169	—	—	225
339·7	13·06	313·6	105·07	106·87	25·505	—	—	344	—	—
406·4	9·52	387·4	93·13	96·30	35·825	77	—	—	—	—
406·4	11·13	384·1	108·22	111·06	35·825	—	127	—	—	—
406·4	12·57	381·3	121·99	124·53	35·825	—	141	—	—	—
508·0	11·13	485·7	136·04	139·68	44·565	77	—	—	—	—

*Calculated weights, threads and coupling (col 5) are based on 6·10 m lengths.

†Alternative test pressures listed in col 10 and 11 are applicable when so agreed upon between the purchaser and the manufacturer. Alternative test pressures marked with double dagger (‡) are also standard test pressures.

TABLE 2 LONG ROUND-THREAD CASING DIMENSIONS, WEIGHTS AND TEST PRESSURES

(*Clauses* 6.1, 9.3.2 *and* 12.1, and *Fig.* 1)

SIZE OUTSIDE DIAMETER, *D*	WALL THICKNESS, *t*	INSIDE DIAMETER, *d*	CALCULATED WEIGHT		CALCULATED COUPLING WEIGHT	TEST PRESSURE		
						Standard		Alternative†
			Plain End, *Wpe*	Threads and Coupling*, *W*		Grade YSt 39	Grade YSt 56	Grade YSt 39
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
mm	mm	mm	kg/m	kg/m	kg	kg/cm²	kg/cm²	kg/cm²
114·3	6·35	101·6	16·89	17·17	4·114	211	499	344
114·3	7·37	99·6	19·41	19·64	4·114	—	576	—
127·0	6·43	114·1	19·09	19·53	5·697	211	—	316
127·0	7·52	112·0	22·13	22·52	5·697	211	534	366
127·0	9·19	108·6	26·68	27·00	5·697	—	654	—
139·7	6·98	125·7	22·84	23·28	6·364	211	—	309
139·7	7·72	124·3	25·11	25·51	6·364	211	499	344
139·7	9·17	121·4	29·48	29·81	6·364	—	591	—
139·7	10·54	118·6	33·54	33·78	6·364	—	682	—
168·3	7·32	153·7	29·01	30·02	11·258	211	—	267
168·3	8·94	150·4	35·09	35·98	11·258	211	478	330
168·3	10·59	147·1	41·15	41·91	11·258	—	569	—
168·3	12·06	144·2	46·43	47·09	11·258	—	647	—
177·8	8·05	161·7	33·68	34·45	10·736	211	408	281
177·8	9·19	159·4	38·19	38·89	10·736	211	464	323
177·8	10·36	157·1	42·74	43·34	10·736	—	527	—
177·8	11·51	154·8	47·15	47·64	10·736	—	583	—
177·8	12·65	152·5	51·46	51·88	10·736	—	640	—
177·8	13·72	150·4	55·45	55·78	10·736	—	696	—

193·7	8·33	177·0	38·04	39·45	15·526	211	387	267
193·7	9·52	174·7	43·22	44·51	15·526	—	443	—
193·7	10·92	171·9	49·17	50·35	15·526	—	506	—
193·7	12·70	168·3	56·63	57·64	15·526	—	591	—
219·1	8·94	201·2	46·28	48·34	21·536	211	—	253
219·1	10·16	198·8	52·30	54·20	21·536	211	415	288
219·1	11·43	196·2	58·47	60·24	21·536	—	471	—
219·1	12·70	193·7	64·57	66·20	21·536	—	520	—
219·1	14·15	190·8	71·43	72·89	21·536	—	583	—
244·5	8·94	226·6	51·88	54·26	25·297	211	—	225
244·5	10·03	224·4	57·95	60·18	25·297	211	373	253
244·5	11·05	222·4	63·55	65·64	25·297	—	408	—
244·5	11·99	220·5	68·67	70·64	25·297	—	443	—
244·5	13·84	216·8	78·65	80·39	25·297	—	506	—

---

*Calculated weights, threads and coupling (col 5) are based on 6·10 m lengths.

†Alternative test pressures listed in col 9 are applicable when so agreed upon between the purchaser and the manufacturer.

6.2 Tolerances — The following tolerances shall apply:

a) Outside diameter	± 0·75 percent
b) Wall thickness	− 12·5 percent
c) Weight:	
i) Single lengths	+ 6·5 percent − 3·5 percent
ii) Carload lots (18 144 kg, *Min*)	− 1·75 percent

6.2.1 The inside diameter is governed by the outside diameter and weight tolerances.

6.2.2 The tolerance on length of pipe shall be as given in Table 3.

TABLE 3 RANGE LENGTHS

(*Clauses* 6.1.2 *and* 6.2.2)

All lengths in metres

SL No.		RANGE		
		1	2	3
i)	Total range length	4·5 to 7·5	7·5 to 10·5	10·5 or more
ii)	*Range length for 95 percent or more of carload:			
	a) Permissible variation, *Max*	1·8	1·5	1·8
	b) Permissible length, *Min*	5·5	8·5	11·00

*Carload tolerances shall apply only when shipment from the mill to final destination is entirely by rail

7. WORKMANSHIP AND FINISH

7.1 Pipe Ends — Casing shall be furnished threaded and coupled with 3·175 mm pitch round thread or, if so specified in the purchase order with any of the following end finishes:

a) Plain end,

b) Threaded with 3·175 mm pitch round threads as per IS : 3333 (Part II)-1967* without coupling, and

c) Special end finish.

---

*Dimensions for petroleum industry pipe threads: Part II Casing round threads.

7.2 The inside and outside edges of the ends of all pipes shall be free from burrs.

7.3 Coupling Make-Up and Thread Protection — All casing couplings shall be screwed on to the pipe power tight except that they shall be screwed on handling-tight or shipped separately if so specified in the purchase order. A high grade thread compound shall be applied to cover the full surfaces of the engaged thread of either the coupling or pipe before making up the joint. When pipe is furnished threaded and coupled, the field end and the coupling shall be provided with thread protectors. When pipe is furnished threaded, but without couplings attached, each end shall be provided with a thread protector. All exposed threads shall be coated with a high-grade thread compound.

> NOTE — The purpose of making-up couplings handling-tight is to facilitate removal of the couplings for cleaning and inspecting threads and applying fresh thread compound before using the pipe. This procedure has been found to result in less chance for thread leakage, because mill applied couplings made-up power tight, although leak-proof at the time of make-up, may not always remain so after transportation, handling and use

7.4 Coatings — Unless otherwise agreed, pipe shall be given a mill coating to protect it from rusting in transit.

> NOTE — If bare pipe or specially coated pipe is desired, the purchase order should state accordingly. For special coatings, the purchase order should state further whether the coating is to be applied to the full length or whether a certain specified distance from the end is to be left uncoated. Unless otherwise specified, such bare ends are commonly given a coating with oil for protection in transit.

7.5 All finished pipes shall be visually examined and shall be reasonably straight. Welded pipe shall be free from injurious defects, such as defective welds, pits, blisters, slivers and laminations. Seamless pipe shall be free from injurious seams and defects. Pipe ends shall not be rounded out by hammering to secure conformity with threading requirements.

7.5.1 When the depth of defects of either seamless or welded pipe is in excess of 12½ percent of the tabulated wall thickness, such defects shall be considered injurious. Welding or patching of such defects is not permitted.

8. JOINTERS

8.1 If so specified in the purchase order, jointers (two pieces coupled to form a standard length) may be furnished to a maximum of 5 percent of the order, but no length used in making a jointer shall be less than 1.5 metres.

9. PHYSICAL TESTS

9.1 Tensile Test

9.1.1 One tensile test shall be made on a length of pipe from each lot of 400 lengths or less for each size 139·7 mm and smaller and from each lot of 200 lengths or less for each size 168·3 mm and larger, provided that, in the case of heat treated pipe all the lengths in each lot shall have received the same heat-treatment. For multiple length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length.

9.1.2 The yield strength, tensile strength and the percentage elongation of steel when determined in accordance with IS : 1894-1962* with the test pieces given in Fig. 2 shall conform to values given in Table 4.

TABLE 4 TENSILE REQUIREMENTS

(*Clauses* 9.1.2 *and* 10.2)

GRADE	YIELD STRENGTH		TENSILE STRENGTH, *Min* kgf/mm²	ELONGATION, *Min* PERCENT IN 50·8 mm	
	Min kgf/mm²	*Max* kgf/mm²		Strip Specimen	Full Section Specimen
(1)	(2)	(3)	(4)	(5)	(6)
YSt 28	28·1	—	42·2	2	32
YSt 39	38·7	56·2	52·7	20	25
YSt 56	56·2	77·3	70·3	16	18

9.1.3 *Test Specimens* — Tensile test specimens shall be either full-section or strip specimens as shown in Fig. 2 at the option of the manufacturer. Strip specimens from seamless pipe may be taken from any location at the option of the manufacturer. Strip specimens from welded pipe shall be taken approximately 90° from the weld or, at the option of the manufacturer from the skelp, parallel to the direction of rolling and approximately midway between the edge and the centre. Tensile test specimens for heat-treated pipe shall receive the same treatment as the finished pipe.

9.1.3.1 All strip specimens shall be approximately 38 mm wide in the gauge length if suitable curved face testing grips are available;

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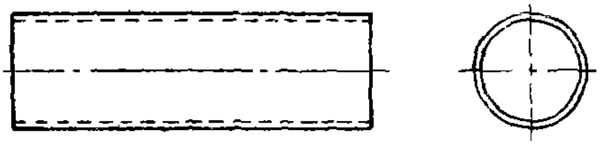
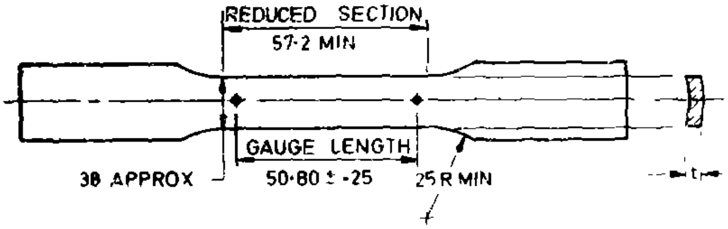
*Method for tensile testing of steel tubes.



FULL-SECTION SPECIMEN



STRIP SPECIMEN

All dimensions in millimetres.

FIG. 2 TENSILE TEST SPECIMEN

otherwise they shall be approximately 25 mm wide for pipe up to 193·7 mm and approximately 38 mm wide for pipes 219·1 mm and larger.

9.1.3.2 Test specimens shall represent the full wall thickness of the pipe from which the specimen was cut and shall be tested without flattening.

9.1.4 *Retests* — If the tensile test specimen representing a lot of pipes fails to conform to the specified requirements, the manufacturer may elect to make retests on two additional lengths from the same lot. If both of the retest specimens conform to the requirements, all the lengths in the lot shall be accepted except the length from which the initial specimen was taken. If one or both of the retest specimens fail to conform to the specified requirements, the manufacturer may elect to test individually the remaining lengths in the lot, in which case determinations are required only for the particular requirements with which the specimens failed to comply in the preceding tests. Specimens for retest shall be taken in the same manner as specified in **9.1.3**, **9.1.3.1** and **9.1.3.2**.

9.1.4.1 If any tensile specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted. When the elongation of any tensile specimen is less than that specified, if any part of the fracture is outside the middle third of the gauge length as indicated by the scribe scratches marked on the specimen before testing, a retest shall be allowed.

9.2 Flattening Test

9.2.1 Flattening tests shall be made for all grades of pipes in accordance with IS . 2328-1963* unless so specified by the purchaser. Except as specified below, test specimens shall be rings or crop ends not less than 63·5 mm long cut from each end of each length of pipe, except that for seamless pipe produced in multiple lengths and subsequently cut into single lengths, flattening tests shall be made on test specimens cut from each end of each multiple length. One flattening test shall be made on the specimen from each lot of 20 lengths or less of each size of pipes. Such a specimen shall be taken either from the finished pipe or taken prior to the normalizing treatment and given the same heat treatment as the finished pipe One flattening test is made on a length of pipe from each lot receiving the same heat treatment. Flattening tests for pipe which is to be heat-treated by quenching, by quenching followed by tempering, or by precipitation hardening, shall be made on one specimen from each lot of 20 lengths or less of each size of pipe, such specimens being taken from the heat-treated pipe or taken prior to heat treatment and given the same heat treatment as the finished pipe. Precaution shall be taken so that the test specimens can be dentified with respect to the lengths of pipe from which they are cut.

9.2.2 For seamless pipe, the test specimen shall be flattened between parallel plates with the specimen held in any position at the discretion of the inspector. No cracks or breaks shall occur anywhere in the specimen until the distance between the plates is less than that specified in Table 5.

9.2.3 For electric welded pipe, the test specimen shall be flattened between parallel plates with the weld at the point of maximum bending and at the discretion of the inspector, separate flattening tests shall be made also with the weld located 90° from the point of maximum bending. Test specimens shall be flattened until the opposite walls of the pipe meet. No cracks or breaks shall occur anywhere in the specimen until the distance between the plates is less than that specified in Table 5, nor shall evidence of poor texture, incomplete fusion in the weld, laminations, burnt metal or extruded metal develop during the entire flattening process.

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*Method for flattening test on steel tubes

TABLE 5 DISTANCE BETWEEN PLATES FOR FLATTENING TESTS

(*Clauses* 9.2.2 *and* 9.2.3)

GRADE	RATIO D/t	DISTANCE BETWEEN PLATES, *Max*
YSt 28	16 and over	0·5 D
YSt 39		0·65 D
YSt 56		0·7 D
YSt 28	Less than 16	$D\ (0{\cdot}83 - 0{\cdot}020\,6\ D/t)$
YSt 39		$D\ (0{\cdot}98 - 0{\cdot}020\,6\ D/t)$
YSt 56		$D\ (1{\cdot}18 - 0{\cdot}03\ D/t)$

where

D = outside diameter of pipe in mm, and

t = wall thickness of pipe in mm

9.2.4 *Retests* — If either test specimen representing a single length of pipe or a multiple length of seamless pipe fails to meet the requirements specified, the manufacturer may elect to make additional tests on specimens cut from the same end of the same length of pipe until the requirements are met, except that the finished pipe shall not be shorter than 80 percent of its length after initial cropping. If any test specimen from a length of pipe representing a lot fails to conform to the requirements specified, the manufacturer may elect to repeat the tests on specimens cut from two additional lengths of pipe from the same lot If such specimens conform to the specified requirements, all the lengths in the lot shall be accepted except the length initially selected for the test. If any of the retest specimens fails to pass the specified requirements, the manufacturer may elect to test the specimens cut from the individual lengths remaining in the lot Specimens for retests shall be taken in the same manner as specified in **9.2.1** At the option of the manufacturer any lot of heat-treated pipe may be re-heat-treated and retested

9.3 Hydrostatic Tests

9.3.1 Each length of pipe shall withstand, without leakage, a minimum hydrostatic pressure as specified in **9.3.2**. Test pressures shall be held for not less than 5 seconds Welded castings shall be struck while under pressure with a 1-kg hammer or its equivalent near the weld at both ends of the pipe. After the above test, the hydrostatic pressure applied to electric welded casing shall be reduced to not less than one-half and maintained for a sufficient period to permit thorough inspection of the weld for leaks or sweats. For threaded casings furnished with couplings made up power tight, the coupling and mill joint shall be tested as specified above, except 508·0 mm pipe which may be tested in the plain end condition. For threaded pipes furnished with couplings made up handling tight, the hydrostatic pressure test shall be made on the pipe in the plain end, threaded or threaded and coupled condition as agreed to between the purchaser and the manufacturer and as specified on the purchase order. If the test is conducted with the coupling made up handling tight, minor leakage at the joint shall be disregarded.

9.3.2 The test pressures shall be as specified in Tables 1 and 2 or a higher pressure as agreed upon between the purchaser and the manufacturer.

NOTE — The hydrostatic test pressures specified in the table are mill inspection test pressures They are not intended to be used as a basis for design and they do not necessarily have any direct relationship to the working pressures.

The hydrostatic test pressures specified herein are based on the following formulæ:

a) For grades YSt 28 and YSt 39 casings:

$$P\ (\text{kgf/cm}^2) = \frac{200\ St}{D}, \text{ or } 211\ \text{kgf/cm}^2 \text{ whichever is smaller; and}$$

b) For grade YSt 56 casing:

$$P\ (\text{kgf/cm}^2) = \frac{200\ St}{D}, \text{ or } 703\ \text{kgf/cm}^2 \text{ whichever is smaller;}$$

where

P = hydrostatic test pressure in kgf/cm^2,
S = fibre stress as given in Table 6,
t = tabulated wall thickness (mm), and
D = tabulated outside diameter (mm).

9.4 Drift Test

9.4.1 Each length of casing shall be tested throughout its entire length with a cylindrical drift mandrel conforming to the requirements listed

TABLE 6 FIBRE STRESS

(*Clause* 9.3.2)

GRADE	STANDARD TEST PRESSURES		ALTERNATIVE TEST PRESSURE, ALL SIZES
	Sizes 244·5 mm and Smaller	*Sizes 273·0 mm* and Larger	
	kgf/mm²	kgf/mm²	kgf/mm²
YSt 28	22·5*	16·9†	22·5*
YSt 39	30·9*	23·2†	30·9*
YSt 56	45·0*	45·0*	—

*Based on 80 percent of the specified minimum yield strengths.

†Based on 60 percent of the specified minimum yield strengths.

below. The drift mandrel shall pass freely through the pipe with a minimum of exerted force

Outside Diameter mm	*Drift Mandrel Size*	
	Length	Diameter, *Min*
	mm	mm
219·1 and smaller	152·4	3·18
244·5 to 339·7, including	304·8	3·97
406·4 and larger	304·8	4·76

10. COUPLING

10.1 Unless otherwise specified, couplings shall be of the same grade as the pipe except Grade YSt 28 pipe in which case couplings of Grade YSt 39 may be used.

10.2 Physical Properties — Couplings for Grades YSt 39 and YSt 56 shall conform to the tensile requirements specified in Table 4. A tensile test shall be made on each heat of steel from which couplings are produced and the coupling manufacturer shall maintain a record of such tests. This record shall be open to inspection by the purchaser

10.3 Dimensions and Tolerances — Couplings shall conform to the dimensions and tolerances shown in Table 7 The inside and outside edges of the bearing face shall be rounded or broken but shall not materially reduce dimension *b* so that enough thickness is left to safely support the pipe on the elevator. The ends of the couplings shall be faced true at right angles to the axis

TABLE 7 ROUND-THREAD CASING COUPLING DIMENSIONS AND TOLERANCES

(*Clauses* 10.3 *and* 10.6.1, and *Fig.* 1)

All Dimensions in millimetres.

SIZE	OUTSIDE DIAMETER, *W*	LENGTH		DIAMETER OF RECESS, *Q*	WIDTH OF BEARING FACE *b*
		Short *NL*	Long *NL*		
(1)	(2)	(3)	(4)	(5)	(6)
mm					
114·3	127·0	158·8	177·8	116·7	4·0
127·0	141·3	165·1	196·8	129·4	4·8
139·7	153·7	171·4	203·2	142·1	3·2
168·3	187·7	184·2	222·2	170·7	6·4
177·8	194·5	184·2	228·6	180·2	4·8
193·7	215·9	190·5	235·0	196·1	6·4
219·1	244·5	196·8	254·0	221·5	7·1
244·5	269·9	196·8	266·7	246·9	7·1
273·0	298·4	203·2	—	275·4	7·1
298·4	323·8	203·2	—	300·8	7·1
339·7	365·1	203·2	—	342·1	7·9
406·4	431·8	228·6	—	408·8	7·9
508·0	533·4	228·6	292·1	510·4	7·9

NOTE — Tolerance on outside diameter *W* is ±1 percent, but not greater than ±3·18 mm.

10.4 Threading — Coupling threads shall conform to the requirements of IS : 3333 (Part II)-1967*

10.5 Surface Inspection

10.5.1 Finished couplings shall be free of all visible seams or cracks.

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*Dimensions for petroleum industry pipe threads: Part II Casing round threads.

10.5.2 Finished couplings with pits, round bottom gouges and similar imperfections are not the cause for rejection unless the depth of the imperfection exceeds that shown below:

Coupling for Pipe Sizes O/D in mm	*Permissible Depth of Imperfection, mm*
139·7 and smaller	0·9
168·3, 177·8 and 193·7	1·14
219·1 and larger	1·5

10.5.3 Finished couplings with grip marks, sharp bottom gouges and similar imperfections are not the cause for rejection unless the depth of imperfection exceeds that shown below:

Coupling for Pipe Sizes O/D in mm	*Permissible Depth of Imperfection, mm*
139·7 and smaller	0·75
168·3 and larger	1·00

10.5.4 Couplings shall be free of imperfections on the inside which break the continuity of the thread.

10.6 Measurement of Imperfections — The depth of imperfections shall be measured from the normal surface or contour of the coupling extended over the imperfection. The outside diameter of the coupling shall be measured from the normal surface or contour of the coupling and not from the base of an acceptable pit.

10.6.1 *Repair and Removal of Imperfections* — Repair welding of imperfections is not permitted. All seams or cracks may be removed and all other imperfections may be removed or reduced to acceptable limits, by machining or grinding on the outer surface, provided the outside diameter of the finished coupling after machining or grinding is within the tolerance specified in Table 7. The machining or grinding should be approximately rounded to the outer contour of the coupling.

11. THREAD PROTECTORS

11.1 Design — The manufacturer shall apply external and internal thread protectors of such design, material and mechanical strength to protect the thread end of the pipe from damage under normal handling and transporation. External thread protectors shall cover the full length of the thread on the pipe and internal thread protectors shall cover the equivalent total pipe-thread length of the internal thread.

Thread protectors shall exclude water and dirt from the thread during transportation and normal storage period. Normal storage period shall be considered as approximately one year. The thread forms in protectors shall be such that the product threads are not damaged by the protectors.

11.2 Material — Protector material shall contain no compounds capable of causing corrosion on promoting adherence of the protectors to the threads and shall be suitable for service temperatures of −46° to +66°C.

12. MARKING

12.1 The pipes shall be marked with the following particulars:

a) Manufacturer's name or trade-mark.

b) Size.

c) Weight per metre.

d) Grade.

e) *Process of Manufacture* — The symbol *S* may be used to denote seamless pipes and E to denote electric welded pipes.

f) *Type of Steel* — The following symbols may be used

Electric furnace steel	*E*
Open hearth steel	*R*
Basic oxygen steel	*BO*

Suitable symbols may be used for steels made by other approved processes.

g) *Length* — The total length of the pipe in metres and centimetres shall be paint stencilled on the finished pipe.

h) *Test Pressure* — When the specified hydrostatic test pressure is higher than the tabulated pressure (*see* Tables 1 and 2) the test pressure in kgf/cm^2 preceded by the word TESTED shall be paint stencilled.

j) *Total Weight* — For sizes 114·3 mm and larger, the total weight in kg shall be paint stencilled.

12.1.1 The pipes may also be marked with the Standard Mark Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

12.1.2 These markings shall be die stamped or paint stencilled, or both unless otherwise agreed to between the purchaser and the manufacturer. The markings shall not overlap and shall be applied in such a manner as not to injure the pipe. For sizes under 339·7 mm the particulars shall be die-stamped unless otherwise agreed upon between the purchaser and the manufacturer. For sizes 406·4 mm and larger the particulars shall be paint stencilled.

12.2 Die-Stamped Markings — Die-stamped markings shall be placed on each length of pipe within 300 mm from the end. No marking shall appear within 200 mm from either end. Die-stamped markings shall be placed on the outside surface or if so agreed upon between the purchaser and the manufacturer, on the inside surface with location and sequence at the option of the manufacturer. Die stamping shall be done with stamps having a blunt or rounded edge to minimize the possibility of stress concentration. For sizes 406·4 mm and larger, die-stamped markings are not required. The size of die-stamped markings shall be 6·35 mm The sequence of die-stamped marking shall be as follows:

a) Manufacturer's name or trade-mark,
b) Weight per metre,
c) Grade of pipe,
d) Process of manufacture, and
e) Type of steel.

12.3 Paint-Stencilled Markings — Paint-stencilled markings shall be placed on the outside surface of each length of pipe, or if so agreed upon between the manufacturer and the purchaser on the inside surface with location and sequence of the markings at the option of the manufacturer If placed on the outside surface, the markings, except the length marking, shall start approximately 300 mm from the end of the pipe and the individual markings shall be separated by dashed or adequate spaces. The sequence of marking shall be as shown below. The length of marking shall be applied at a location convenient to the manufacturer, but starting within 600 mm of the end of the pipe

a) Size,
b) Weight per metre,
c) Grade of pipe,
d) Process of manufacture,

e) Type of steel, and

f) Hydrostatic test pressure.

12.4 Markings for couplings and method of application shall be as follows:

> The manufacturer's name or trade-mark and the symbol for the grade shall be die stamped unless otherwise agreed upon between the purchaser and the manufacturer in which case they shall be paint stencilled.

12.5 Colour Identification — In addition to the required markings as specified above, each length of casing pipe shall be identified by colour identification in the form of paint band or bands as indicated below encircling the pipe at a distance not greater than 0·6 m from the coupling or box or completely covering the coupling or box or both. The colours shall be as follows:

Grade YSt 29	No colour marking or black at the manufacturer's option.
Grade YSt 39	Two bright green bands.
Grade YSt 56	One red band.

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